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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/039,459	11/07/2001	Hariprasad Sreedharamurthy	MEMC 99-1250/2441.1	1061

321 7590 11/21/2002

SENNIGER POWERS LEAVITT AND ROEDEL  
ONE METROPOLITAN SQUARE  
16TH FLOOR  
ST LOUIS, MO 63102

EXAMINER

SONG, MATTHEW J

ART UNIT	PAPER NUMBER
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1765

DATE MAILED: 11/21/2002

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Please find below and/or attached an Office communication concerning this application or proceeding.

# Office Action Summary

Application No.

10/039,459

Applicant(s)

SREEDHARAMURTHY ET AL.

Examiner

Matthew J Song

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-- Th MAILING DATE f this communication appears on the cover sheet with the correspondenc address --

## Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☐ Responsive to communication(s) filed on \_\_\_\_.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 1-33 is/are pending in the application.
- 4a) Of the above claim(s) 15-33 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-14 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 18 April 2002 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

## Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

## Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 4.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). \_\_\_\_.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_.

**DETAILED ACTION**

***Election/Restrictions***

1. Restriction to one of the following inventions is required under 35 U.S.C. 121:

- I. Claims 1-14, drawn to an apparatus, classified in class 117, subclass 200.
- II. Claims 15-33, drawn to a method, classified in class 117, subclass 13.

2. Inventions I and II are related as process and apparatus for its practice. The inventions are distinct if it can be shown that either: (1) the process as claimed can be practiced by another materially different apparatus or by hand, or (2) the apparatus as claimed can be used to practice another and materially different process. (MPEP § 806.05(e)). In this case the process as claimed can be practiced by another and materially different apparatus, such as one not employing a Czochralski pulling method, for example a downward pulling apparatus.

3. Because these inventions are distinct for the reasons given above and have acquired a separate status in the art as shown by their different classification, restriction for examination purposes as indicated is proper.

4. During a telephone conversation with Edward Hejlek on 11/6/2002 a provisional election was made with traverse to prosecute the invention of I, claims 1-14. Affirmation of this election must be made by applicant in replying to this Office action. Claims 15-33 withdrawn from further consideration by the examiner, 37 CFR 1.142(b), as being drawn to a non-elected invention.

***Claim Rejections - 35 USC § 112***

5. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

6. Claim 10 and 14 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Claim 10 recites "the structural component reaches at least about 950°C for at least about 80 hours and is within about 3 cm to about 5 cm of the silicon single crystal". The scope of the protection is unclear as the claim recites process limitations but is directed to an apparatus, likewise for claim 14.

***Claim Rejections - 35 USC § 101***

7. 35 U.S.C. 101 reads as follows:

Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

8. Claims 10 and 14 are rejected under 35 U.S.C. 101 because the claimed invention is directed to non-statutory subject matter. Claim 10 recites "the structural component reaches at least about 950°C for at least about 80 hours and is within about 3 cm to about 5 cm of the silicon single crystal". The scope of the protection is unclear as the claim recites process limitations but is directed to an apparatus

***Claim Rejections - 35 USC § 103***

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9. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

10. Claims 1-9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Holder et al (WO 99/66108).

Holder et al discloses an Czochralski apparatus for preparing silicon crystals with reduced metal content, note entire reference, comprising graphite hot zone structures: a heater 16, susceptor 14, thermal shield 18, heat reflectors, pure tubes, insulation and view port channels and a crystal growth chamber 4. Holder et al also discloses the graphite utilized to construct the hot zone structures is generally at least 99.99% pure graphite with less than about 5 ppm, this is reads on a concentration down to 0 ppm, total metals such as iron, where the particle generation during high temperature heating decreases as the purity of the graphite increases (pg 7). Holder et al also discloses a protective coating of silicon carbide about 75-150 micrometers thick covering the entire surface to grown directly on the graphite components covering the entire surface to maximize protection comprises 99.99% silicon carbide and 0.01% silicon. Holder et al is silent to an iron content of the protective layer, but because the protective coating is 100% silicon carbide and silicon (99.99% silicon carbide and 0.01% silicon), the iron content in the silicon carbide can be determined to be 0 (pg 10).

Holder et al discloses a substrate with a concentration of iron no greater than 5 ppm.

Holder et al does not disclose a substrate with a concentration of iron no greater than  $1.5 \times 10^{12}$

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atoms/cm<sup>3</sup> or an iron concentration of the protective layer is no greater than  $1.0 \times 10^{12}$  atoms/cm.

Overlapping ranges are held to be obvious (MPEP 2144.05).

Referring to claim 2-4, Holder et al discloses a substrate with a concentration of iron no greater than 5 ppm. Holder et al does not disclose a substrate with a concentration of iron no greater than  $0.1 \times 10^{12}$  atoms/cm<sup>3</sup>. Overlapping ranges are held to be obvious (MPEP 2144.05).

Referring to claim 5-6, Holder et al discloses a protective layer of 100% silicon carbide and silicon, therefore an iron content can be determined to be 0%, which is less than  $0.1 \times 10^{12}$  atoms/cm<sup>3</sup>. Overlapping ranges are held to be obvious (MPEP 2144.05).

Referring to claim 7-8, Holder et al discloses a layer thickness of 75-125 micrometers.

Referring to claim 9, Holder et al discloses covering the entire surface to maximize the effectiveness.

11. Claims 10 and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Holder et al (WO 99/66108) in view of Falster et al (US 5,919,302) and Kim et al (US 5,942,032).

Holder et al discloses all of the limitations of claim 10, as discussed previously, except the structure component reaches at least 950°C for at least about 80 hours and is within 3 cm to about 5 cm of the silicon single crystal or the silicon melt.

In a Czochralski method for forming low defect density silicon, note entire reference, Falster et al teaches a ingot is cooled from a solidification temperature to a temperature in excess of about 1050°C over a period of at least about 75 hours and control of the cooling rate can be achieved by using any means currently known in the art for minimizing heat transfer, including the use of insulators, heaters, radiation shields and magnetic fields (col 9, ln 1-67). It would have

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been obvious to a person of ordinary skill in the art at the time of the invention to modify Holder et al with Falster et al to form an ingot having an axially symmetric region, which is substantially free of defects (col 3, ln 1-67).

In a single crystal pulling apparatus, note entire reference, Kim et al discloses a lower heat shield **42** is about 50-60 mm above the surface of a the melt in a crucible (col 9, ln 1-67) to prevent heat from radiating from the side walls of the crucible to a ingot except in the space between the bottom of the lower heat shield and the surface of the melt. Kim et al also discloses an upper heat shield **36**, an intermediate heat shield **40** and vertically arranged heating panels **24**, where the heating panel which heats the interior of the crystal puller reads on applicant's upper heater, composed of graphite and the intermediate heat shield supports the upper heat shield (col 6, ln 1-67). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Holder et al and Falster et al with Kim et al to inhibit agglomeration of defects in the crystal growth process (col 3, ln 1-67).

12. Claims 11-13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Holder et al (WO 99/66108) in view of Falster et al (US 5,919,302) and Kim et al (US 5,942,032) as applied to claims 10 and 14 above, and further in view of Luter et al (5,922,127).

The combination of Holder et al, Falster et al and Kim et al teaches all of the limitations of claim 11, as discussed previously, except a lower heat shield reflector, a lower heat shield outer reflector, a lower heat shield insulation layer

In a crystal pulling apparatus, note entire reference, Luter et al discloses a heat shield **40** comprising a graphite insulation layer **42** sandwiched between an inner **42** and outer reflector **46**.

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It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Holder et al, Falster et al and Kim et al with Luter et al to distribute defects more evenly throughout the ingot to improve the overall quality of the ingot (col 6, ln 50-67).

Referring to claim 11, the combination of Holder et al, Falster et al, Kim et al and Luter et al teaches inner **42** and outer reflector **46**, a upper heat shield **36**, an intermediate heat shield **40**, lower heat shield **42**, an upper heater **24**, where the intermediate heat shield provides support for the upper heat shield, which acts as an insulation shield.

Referring to claim 12-13, the combination of Holder et al, Falster et al, Kim et al and Luter et al teaches a silicon carbide layer covering graphite components in a hot zone, including reflectors, insulation, heaters and heat shields.

### *Conclusion*

13. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Kobayashi et al (US 4,912,302) teaches carbon heaters composed of graphite with an iron content of not more than 9 ppm (abstract).

Vilzmann et al (US 5,578,123) teaches a single crystal is enclosed by a body **6**, where the lower end of body **9** and the surface **10** of a melt is from 5 to 50 mm so that gas may flow (col 3).

Holder et al (US 6,183,553) discloses the same subject matter as Holder et al (WO 99/66108), note entire reference.



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Von Ammon et al (US 6,132,507) teaches a heat shield acts as thermal insulation (col 2, ln 5-15) and a reflector 1 mounted 10-20 mm above a melt surface, note entire reference.


14. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Matthew J Song whose telephone number is 703-305-4953. The examiner can normally be reached on M-F 9:00-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Benjamin L Utech can be reached on 703-308-3868. The fax phone numbers for the organization where this application or proceeding is assigned are 703-872-9310 for regular communications and 703-872-9311 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0661.

Matthew J Song  
Examiner  
Art Unit 1765

MJS  
November 19, 2002

  
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